



General

Guideline Title

Summary of evidence-based guideline update: evaluation and management of concussion in sports. Report of the Guideline Development Subcommittee of the American Academy of Neurology.

Bibliographic Source(s)

Giza CC, Kutcher JS, Ashwal S, Barth J, Getchius TS, Gioia GA, Gronseth GS, Guskiewicz K, Mandel S, Manley G, McKeag DB, Thurman DJ, Zafonte R. Summary of evidence-based guideline update: evaluation and management of concussion in sports: Report of the Guideline Development Subcommittee of the American Academy of Neurology. *Neurology*. 2013 Jun 11;80(24):2250-7. [40 references] [PubMed](#)

Guideline Status

This is the current release of the guideline.

This guideline updates a previous version: American Academy of Neurology, Quality Standards Subcommittee. Practice parameter: the management of concussion in sports (summary statement). *Neurology* 1997 Mar;48(3):581-5. [66 references]

Recommendations

Major Recommendations

Definitions of the levels of the recommendations (A, B, C, U) and classification of the evidence (Class I-IV) are provided at the end of the "Major Recommendations" field.

For this guideline, recommendations have each been categorized as 1 of 3 types: 1) preparticipation counseling recommendations; 2) recommendations related to assessment, diagnosis, and management of suspected concussion; and 3) recommendations for management of diagnosed concussion (including acute management, return to play [RTP], and retirement). The term experienced licensed health care provider (LHCP) refers to an individual who has acquired knowledge and skills relevant to evaluation and management of sports concussions and is practicing within the scope of his or her training and experience. The role of the LHCP can generally be characterized in 1 of 2 ways: sideline (at the sporting event) or clinical (at an outpatient clinic or emergency room).

Preparticipation Counseling

1. School-based professionals should be educated by experienced LHCPs designated by their organization/institution to understand the risks of experiencing a concussion so that they may provide accurate information to parents and athletes (Level B).
2. To foster informed decision-making, LHCPs should inform athletes (and where appropriate, the athletes' families) of evidence concerning the concussion risk factors. Accurate information regarding concussion risks also should be disseminated to school systems and sports authorities (Level B).

Suspected Concussion

Use of Checklists and Screening Tools

1. Inexperienced LHCPs should be instructed in the proper administration of standardized validated sideline assessment tools. This instruction should emphasize that these tools are only an adjunct to the evaluation of the athlete with suspected concussion and cannot be used alone to diagnose concussion (Level B). These providers should be instructed by experienced individuals (LHCPs) who themselves are licensed, knowledgeable about sports concussion, and practicing within the scope of their training and experience, designated by their organization/institution in the proper administration of the standardized validated sideline assessment tools (Level B).
2. In individuals with suspected concussion, these tools should be utilized by sideline LHCPs and the results made available to clinical LHCPs who will be evaluating the injured athlete (Level B).
3. LHCPs caring for athletes might utilize individual baseline scores on concussion assessment tools, especially in younger athletes, those with prior concussions, or those with preexisting learning disabilities/attention-deficit/hyperactivity disorder, as doing so fosters better interpretation of postinjury scores (Level C).
4. Team personnel (e.g., coaching, athletic training staff, sideline LHCPs) should immediately remove from play any athlete suspected of having sustained a concussion, in order to minimize the risk of further injury (Level B).
5. Team personnel should not permit the athlete to return to play until the athlete has been assessed by an experienced LHCP with training both in the diagnosis and management of concussion and in the recognition of more severe traumatic brain injury (TBI) (Level B).

Neuroimaging

Computed tomography (CT) imaging should not be used to diagnose sport-related concussion (SRC) but might be obtained to rule out more serious TBI such as an intracranial hemorrhage in athletes with a suspected concussion who have loss of consciousness (LOC), posttraumatic amnesia, persistently altered mental status (Glasgow Coma Scale <15), focal neurologic deficit, evidence of skull fracture on examination, or signs of clinical deterioration (Level C).

Management of Diagnosed Concussion

RTP: Risk of Recurrent Concussion

1. In order to diminish the risk of recurrent injury, individuals supervising athletes should prohibit an athlete with concussion from returning to play/ practice (contact-risk activity) until an LHCP has judged that the concussion has resolved (Level B).
2. In order to diminish the risk of recurrent injury, individuals supervising athletes should prohibit an athlete with concussion from returning to play/ practice (contact-risk activity) until the athlete is asymptomatic off medication (Level B).

RTP: Age Effects

1. Individuals supervising athletes of high school age or younger with diagnosed concussion should manage them more conservatively regarding RTP than they manage older athletes (Level B).
2. Individuals using concussion assessment tools for the evaluation of athletes of preteen age or younger should ensure that these tools demonstrate appropriate psychometric properties of reliability and validity (Level B).

RTP: Concussion Resolution

Clinical LHCPs might use supplemental information, such as neurocognitive testing or other tools, to assist in determining concussion resolution. This may include but is not limited to resolution of symptoms as determined by standardized checklists and return to age-matched normative values or an individual's preinjury baseline performance on validated neurocognitive testing (Level C).

RTP: Graded Physical Activity

LHCPs might develop individualized graded plans for return to physical and cognitive activity, guided by a carefully monitored, clinically based approach to minimize exacerbation of early postconcussive impairments (Level C).

Cognitive Restructuring

Cognitive restructuring is a form of brief psychological counseling that consists of education, reassurance, and reattribution of symptoms. Whereas there are no specific studies using cognitive restructuring specifically in sports concussions, multiple studies using this intervention for mild traumatic brain injury (mTBI) have shown benefit in decreasing the proportion of individuals who develop chronic postconcussion syndrome. Therefore, LHCPs might provide cognitive restructuring counseling to all athletes with concussion to shorten the duration of subjective symptoms and diminish

the likelihood of development of chronic postconcussion syndrome (Level C).

Retirement From Play After Multiple Concussions: Assessment

1. LHCPs might refer professional athletes with a history of multiple concussions and subjective persistent neurobehavioral impairments for neurologic and neuropsychological assessment (Level C).
2. LCHPs caring for amateur athletes with a history of multiple concussions and subjective persistent neurobehavioral impairments might use formal neurologic/cognitive assessment to help guide retirement-from-play decisions (Level C).

Retirement From Play After Multiple Concussions: Counseling

1. LHCPs should counsel athletes with a history of multiple concussions and subjective persistent neurobehavioral impairment about the risk factors for developing permanent or lasting neurobehavioral or cognitive impairments (Level B).
2. LHCPs caring for professional contact sport athletes who show objective evidence for chronic/persistent neurologic/cognitive deficits (such as seen on formal neuropsychological testing) should recommend retirement from the contact sport to minimize risk for and severity of chronic neurobehavioral impairments (Level B).

Definitions:

American Academy of Neurology (AAN) Rules for Classification of Evidence for Risk of Bias

For Questions Related to Diagnostic Accuracy

Class I

- Study is a cohort survey with prospective data collection.
- Study includes a broad spectrum of persons suspected of having the disease.
- Disease status determination is objective or made without knowledge of diagnostic test result.
- The following also are required:
 - a. Inclusion criteria are defined.
 - b. At least 80% of enrolled subjects have both the diagnostic test and disease status measured.

Class II

- Study is a cohort study with retrospective data collection or is a case-control study. Study meets criteria a–b.
- Study includes a broad spectrum of persons with the disease and persons without the disease.
- The diagnostic test result and disease status are determined objectively or without knowledge of one or the other.

Class III

- Study is a cohort or case-control study.
- Study includes a narrow spectrum of persons with or without the disease.
- The diagnostic test result and disease status are determined objectively, without knowledge of one or the other, or by different investigators.

Class IV

- The study does not include persons suspected of the disease.
- The study does not include patients with the disease and patients without the disease.
- The study uses an undefined or unaccepted independent reference standard.
- No measures of diagnostic accuracy or statistical precision are presented or calculable.

For Questions Related to Therapeutic Intervention

Class I

- The study is a randomized clinical trial.
- All relevant baseline characteristics are presented and substantially equivalent between treatment groups or there is appropriate statistical adjustment for differences.
- Outcome measurement is objective or determined without knowledge of treatment status.
- The following also are required:

- a. The primary outcome(s) is/are defined.
- b. The inclusion criteria are defined.
- c. There is accounting of dropouts and crossovers (with at least 80% of enrolled subjects completing the study).
- d. There is concealed allocation.

Class II

- The study is a cohort study meeting criteria a–c above or is a randomized, controlled trial that lacks one or two criteria a–d.
- All relevant baseline characteristics are presented and substantially equivalent among treatment groups, or there is appropriate statistical adjustment for differences.
- There is masked or objective outcome assessment.

Class III

- The study is a controlled study (including well-defined natural history controls or patients serving as their own controls).
- The study includes a description of major confounding differences between treatment groups that could affect outcome.
- Outcome assessment is masked, objective, or performed by someone who is not a member of the treatment team.

Class IV

- The study does not include patients with the disease.
- The study does not include patients receiving different interventions.
- The study uses undefined or unaccepted interventions or outcome measures.
- No measures of effectiveness or statistical precision are presented or calculable.

Classification of Recommendations

A = Established as effective, ineffective or harmful (or established as useful/predictive or not useful/predictive) for the given condition in the specified population. (Level A rating requires at least two consistent Class I studies.)*

B = Probably effective, ineffective or harmful (or probably useful/predictive or not useful/predictive) for the given condition in the specified population. (Level B rating requires at least one Class I study or two consistent Class II studies.)

C = Possibly effective, ineffective or harmful (or possibly useful/predictive or not useful/predictive) for the given condition in the specified population. (Level C rating requires at least one Class II study or two consistent Class III studies.)

U = Data inadequate or conflicting; given current knowledge, treatment (test, predictor) is unproven.

*In exceptional cases, one convincing Class I study may suffice for an "A" recommendation if 1) all criteria are met, 2) the magnitude of effect is large (relative rate improved outcome >5 and the lower limit of the confidence interval is >2).

Clinical Algorithm(s)

None provided

Scope

Disease/Condition(s)

Concussion

Guideline Category

Counseling

Diagnosis

Evaluation

Management

Risk Assessment

Treatment

Clinical Specialty

Emergency Medicine

Family Practice

Neurology

Pediatrics

Physical Medicine and Rehabilitation

Sports Medicine

Intended Users

Advanced Practice Nurses

Allied Health Personnel

Emergency Medical Technicians/Paramedics

Health Care Providers

Nurses

Other

Patients

Physician Assistants

Physicians

Guideline Objective(s)

- To update the 1997 American Academy of Neurology (AAN) practice parameter regarding sports concussion
- To answer the following clinical questions:
 - What factors increase/decrease concussion risk?
 - What diagnostic tools identify those with concussion and those at increased risk for severe/prolonged early impairments, neurologic catastrophe, or chronic neurobehavioral impairment?
 - What clinical factors identify those at increased risk for severe/prolonged early postconcussion impairments, neurologic catastrophe, recurrent concussions, or chronic neurobehavioral impairment?
 - What interventions enhance recovery, reduce recurrent concussion risk, or diminish long-term sequelae?

Target Population

Children, adolescents, and adults at risk of, or with sports-related concussion

Interventions and Practices Considered

1. Participation counseling
 - Education of school-based professionals
 - Counseling of athletes (and where appropriate, the athletes' families) of evidence concerning the concussion risk factors.
 - Provision of information regarding concussion risks to school systems and sports authorities
2. Management of suspected concussion
 - Checklists and screening tools (standardized validated sideline assessment tools)
 - Removal of athlete from play
 - Computed tomography (CT) imaging (as indicated)
3. Management of diagnosed concussion
 - Criteria for return to play/practice (risk of recurrent confusion, age effects, concussion resolution, graded physical activity)
 - Cognitive restructuring
4. Retirement from play after multiple concussions
 - Neurologic, neuropsychological, cognitive assessment
 - Counseling of athletes

Major Outcomes Considered

Incidence and severity of:

- Concussion
- Post-concussion impairments
- Recurrent concussion
- Neurologic catastrophe
- Long-term sequelae of concussion
- Chronic neurobehavioral impairment

Methodology

Methods Used to Collect/Select the Evidence

Searches of Electronic Databases

Description of Methods Used to Collect/Select the Evidence

A medical research librarian assisted the panel in performing a comprehensive literature search of multiple databases to obtain the relevant studies. Articles were selected for inclusion and rated for quality independently by two authors. The search strategy is described in Appendix 4 of the data supplement (see the "Availability of Companion Documents" field).

Only papers relevant to sports concussion or sports-related mild-traumatic brain injury (mTBI) published between 1955 and June 2012 were included. A study's quality (risk of bias) as it pertains to the questions was measured by the American Academy of Neurology's four-tiered classification of evidence schemes pertinent to diagnostic or therapeutic questions (see 'Rating Scheme for the Strength of the Evidence' field). Class I and II studies are discussed in the guideline text and documented in the evidence tables (see appendix 6 of the data supplement [see the "Availability of Companion Documents" field]). Class III studies are included in the evidence tables but may not have been mentioned in the text if multiple studies with higher levels of evidence are available. Class IV studies such as case series or meta-analyses have been excluded. Characteristics influencing a study's risk of bias and generalizability were abstracted using a structured data collection form. Each article was selected for inclusion and study characteristics abstracted independently by two panel members. Disagreements were resolved by discussion between the two panel members. A third panel member adjudicated remaining disagreements. Evidence tables were constructed from the abstracted study characteristics.

Number of Source Documents

- Clinical Question 1: 132 articles
- Clinical Question 2: 195 articles
- Clinical Question 3: 235 articles
- Clinical Question 4: 15 articles

Methods Used to Assess the Quality and Strength of the Evidence

Weighting According to a Rating Scheme (Scheme Given)

Rating Scheme for the Strength of the Evidence

Therapeutic

Class I

- Randomized, controlled clinical trial (RCT) in a representative population
- Masked or objective outcome assessment
- Relevant baseline characteristics are presented and substantially equivalent between treatment groups, or there is appropriate statistical adjustment for differences
- Also required:
 - a. Concealed allocation
 - b. No more than two primary outcomes specified
 - c. Exclusion/inclusion criteria clearly defined
 - d. Adequate accounting for dropouts (with at least 80 percent of enrolled subjects completing the study) and crossovers with numbers sufficiently low to have minimal potential for bias
 - e. For noninferiority or equivalence trials claiming to prove efficacy for one or both drugs, the following are also required*:
 1. The authors explicitly state the clinically meaningful difference to be excluded by defining the threshold for equivalence or noninferiority
 2. The standard treatment used in the study is substantially similar to that used in previous studies establishing efficacy of the standard treatment (e.g., for a drug, the mode of administration, dose, and dosage adjustments are similar to those previously shown to be effective)
 3. The inclusion and exclusion criteria for patient selection and the outcomes of patients on the standard treatment are comparable to those of previous studies establishing efficacy of the standard treatment
 4. The interpretation of the study results is based on a per-protocol analysis that accounts for dropouts or crossovers
 - f. For crossover trials, both period and carryover effects examined and statistical adjustments performed, if appropriate

Class II

- An RCT that lacks one or two criteria a–e (see Class I) or a cohort study meeting criteria b–e (see Class I)
- Randomized, crossover trial missing one of the following two criteria:
 - a. Period and carryover effects described
 - b. Baseline characteristics of treatment order groups presented
- All relevant baseline characteristics are presented and substantially equivalent among treatment groups, or there is appropriate statistical adjustment for differences
- Masked or objective outcome assessment

Class III

- Controlled studies (including studies with external controls such as well-defined natural history controls)
- Crossover trial missing both of the following two criteria:
 - a. Period and carryover effects
 - b. Baseline characteristics presented
- A description of major confounding differences between treatment groups that could affect outcome**

- Outcome assessment masked, objective, or performed by someone who is not a member of the treatment team

Class IV

- Did not include patients with the disease
- Did not include patients receiving different interventions
- Undefined or unaccepted interventions or outcome measures
- No measures of effectiveness or statistical precision presented or calculable

* Numbers 1–3 in Class Ie are required for Class II in equivalence trials. If any one of the three is missing, the class is automatically downgraded to Class III.

** Objective outcome measurement: An outcome measure that is unlikely to be affected by an observer's (patient, treating physician, investigator) expectation or bias (e.g., blood tests, administrative outcome data)

Note: The AAN also provides evidence classification schemes for causation and prognostic questions in the "Clinical Practice Guideline Process Manual" (see the "Availability of Companion Documents" field).

Methods Used to Analyze the Evidence

Systematic Review with Evidence Tables

Description of the Methods Used to Analyze the Evidence

Evidence was synthesized and conclusions developed using a modified form of the Grading of Recommendations Assessment, Development and Evaluation (GRADE) process. The confidence in evidence was anchored to the studies' risk of bias according to the rules outlined in appendix 7 of the full-length guideline document (see the "Availability of Companion Documents" field). The overall confidence in the evidence pertinent to a question could be downgraded by one or more levels on the basis of five factors: consistency, precision, directness, publication bias, or biological plausibility. In addition, the overall confidence in the evidence pertinent to a question could be downgraded one or more levels or upgraded by one level on the basis of three factors: magnitude of effect, dose response relationship, or direction of bias. Two panel members working together completed an evidence summary table to determine the final confidence in the evidence (see appendix 7 in the full-length guideline document [see the "Availability of Companion Documents" field]). The confidence in the evidence is indicated by use of modal operators in conclusion statements in the guideline. "Highly likely" or "highly probable" corresponds to high confidence level, "likely" or "probable" corresponds to moderate confidence level, and "possibly" corresponds to low confidence level. Very low confidence is indicated by the term "insufficient evidence."

Methods Used to Formulate the Recommendations

Expert Consensus (Delphi)

Description of Methods Used to Formulate the Recommendations

A multidisciplinary panel was formed, including representatives from child and adult neurology, athletic training, child and adult neuropsychology, epidemiology and biostatistics, neurosurgery, physical medicine and rehabilitation, and sports medicine.

The panel formulated a rationale for recommendations (see appendix 8 in the full-length guideline document [see the "Availability of Companion Documents" field]) based on the evidence systematically reviewed, on stipulated axiomatic principles of care, and, when evidence directly related to sports concussion was unavailable, on strong evidence derived from the non-sports-related traumatic brain injury (TBI) literature. This rationale is explained in a section labeled "Clinical Context" which precedes each set of recommendations. From this rationale, corresponding actionable recommendations were inferred. To reduce the risk of bias from the influences of "group think" and dominant personalities, the clinician level of obligation (CLO) of the recommendations was assigned using a modified Delphi process that considered the following prespecified domains: the confidence in the evidence systematically reviewed, the acceptability of axiomatic principles of care, the strength of indirect evidence, and the relative magnitude of benefit to harm. Additional factors explicitly considered by the panel that could modify the CLO include judgments regarding the importance of outcomes, cost of compliance to the recommendation relative to benefit, the availability of the intervention, and anticipated variations in athletes' preferences. The prespecified rules for determining the final CLO from these domains is indicated in appendix 8 of the full-

length guideline document [see the "Availability of Companion Documents" field]. The CLO is indicated using standard modal operators. "Must" corresponds to "Level A," very strong recommendations; "should" to "Level B," strong recommendations; and "might" to "Level C," weak recommendations.

Rating Scheme for the Strength of the Recommendations

Assigning a Level of Strength to the Recommendation

When there is sufficient evidence to support an inference for the use of an intervention (i.e., the balance of benefits and harms favors the intervention), the author panel assigns one of three recommendation designations: A, B, or C. Each designation corresponds to a helping verb that denotes the level of strength of the recommendation. Level A is the strongest recommendation level and is denoted by the use of the helping verb *must*. Must recommendations are rare, as they are based on high confidence in the evidence and require both a high magnitude of benefit and low risk. Level B corresponds to the helping verb *should*. *Should* recommendations tend to be more common, as the requirements are less stringent but still based on the evidence and benefit–risk profile. Finally, Level C corresponds to the helping verb *may* or *might*. *May* and *might* recommendations represent the lowest allowable recommendation level the American Academy of Neurology (AAN) considers useful within the scope of clinical practice and can accommodate the highest degree of practice variation.

Level A denotes a practice recommendation that "must" be done. In almost all circumstances, adherence to the recommendation will improve health-related outcomes. A Level B indicates a recommendation that "should" be done. In most circumstances, adherence to the recommendation will likely improve health-related outcomes. A Level C represents a recommendation that "might" be done. In some circumstances, adherence to the recommendation might improve health-related outcomes.

When there is insufficient evidence to support an inference for the use of an intervention (i.e., the balance of benefits and harms is unknown) a Level U or Level R designation is appropriate.

A Level U indicates that the available evidence is insufficient to support or refute the efficacy of an intervention. A Level R is assigned when the balance of benefits and harms is unknown and the intervention is known to be expensive or have important risks. A Level R designates that the intervention should not be used outside of a research setting. Non–evidence-based factors that need to be transparently and systematically considered when formulating recommendations include the following:

- The relative value of the benefit as compared with the risk; this is derived from consideration of:
 - The importance to patients of the health related-outcomes (both benefits and harms)
 - The size of the intervention's effect
 - The risk of harm of the intervention (i.e., tolerability and safety)
- The feasibility of complying with the intervention (e.g., the intervention's availability)
- The cost of the intervention
- The expected variation in patient preferences relative to the risks, burdens, and benefits of the intervention

Cost Analysis

A formal cost analysis was not performed and published cost analyses were not reviewed.

Method of Guideline Validation

External Peer Review

Internal Peer Review

Description of Method of Guideline Validation

Drafts of the original guideline document have been reviewed by at least 3 American Academy of Neurology (AAN) committees, a network of neurologists, Neurology® peer reviewers, and representatives from related fields. The guideline document was approved by the Guideline Development Subcommittee on July 14, 2012; by the Practice Committee on August 3, 2012; and by the AAN Board of Directors on February 8, 2013.

Evidence Supporting the Recommendations

Type of Evidence Supporting the Recommendations

The type of supporting evidence is identified and graded for each recommendation (see the "Major Recommendations" field).

Benefits/Harms of Implementing the Guideline Recommendations

Potential Benefits

- Safe and effective management of concussion
- Decreased incidence and/or severity of:
 - Post-concussion impairments
 - Recurrent concussion
 - Neurologic catastrophe
 - Long-term sequelae of concussion
 - Chronic neurobehavioral impairment

Potential Harms

False positive or false negative results of diagnostic tests

Qualifying Statements

Qualifying Statements

This statement is provided as an educational service of the American Academy of Neurology (AAN). It is based on an assessment of current scientific and clinical information. It is not intended to include all possible proper methods of care for a particular neurologic problem or all legitimate criteria for choosing to use a specific procedure. Neither is it intended to exclude any reasonable alternative methodologies. The AAN recognizes that specific patient care decisions are the prerogative of the patient and the physician caring for the patient, based on all of the circumstances involved. The clinical context section is made available in order to place the evidence-based guideline(s) into perspective with current practice habits and challenges. Formal practice recommendations are not intended to replace clinical judgment.

Implementation of the Guideline

Description of Implementation Strategy

An implementation strategy was not provided.

Implementation Tools

Patient Resources

Quick Reference Guides/Physician Guides

Resources

Slide Presentation

For information about availability, see the *Availability of Companion Documents* and *Patient Resources* fields below.

Institute of Medicine (IOM) National Healthcare Quality Report Categories

IOM Care Need

Getting Better

Staying Healthy

IOM Domain

Effectiveness

Identifying Information and Availability

Bibliographic Source(s)

Giza CC, Kutcher JS, Ashwal S, Barth J, Getchius TS, Gioia GA, Gronseth GS, Guskiewicz K, Mandel S, Manley G, McKeag DB, Thurman DJ, Zafonte R. Summary of evidence-based guideline update: evaluation and management of concussion in sports: Report of the Guideline Development Subcommittee of the American Academy of Neurology. *Neurology*. 2013 Jun 11;80(24):2250-7. [40 references] [PubMed](#)

Adaptation

Not applicable: The guideline was not adapted from another source.

Date Released

1997 (revised 2013 Mar)

Guideline Developer(s)

American Academy of Neurology - Medical Specialty Society

Source(s) of Funding

American Academy of Neurology (AAN)

Guideline Committee

Guideline Development Subcommittee of the American Academy of Neurology (AAN)

Composition of Group That Authored the Guideline

Guideline Authors: Christopher C. Giza, MD*; Jeffrey S. Kutcher, MD*; Stephen Ashwal, MD, FAAN; Jeffrey Barth, PhD; Thomas S.D. Getchius; Gerard A. Gioia, PhD; Gary S. Gronseth, MD, FAAN; Kevin Guskiewicz, PhD, ATC; Steven Mandel, MD, FAAN; Geoffrey Manley, MD, PhD; Douglas B. McKeag, MD, MS; David J. Thurman, MD, FAAN; Ross Zafonte, DO

*These authors contributed equally to the original guideline document.

Financial Disclosures/Conflicts of Interest

Conflict of Interest

The American Academy of Neurology (AAN) is committed to producing independent, critical and truthful clinical practice guidelines (CPGs). Significant efforts are made to minimize the potential for conflicts of interest to influence the recommendations of this CPG. To the extent possible, the AAN keeps separate those who have a financial stake in the success or failure of the products appraised in the CPGs and the developers of the guidelines. Conflict of interest forms were obtained from all authors and reviewed by an oversight committee prior to project initiation. AAN limits the participation of authors with substantial conflicts of interest. The AAN forbids commercial participation in, or funding of, guideline projects. Drafts of the guideline have been reviewed by at least 3 AAN committees, a network of neurologists, Neurology® peer reviewers, and representatives from related fields. The AAN Guideline Author Conflict of Interest Policy can be viewed at the [American Academy of Neurology Web site](#) .

Disclosure

C. Giza is a commissioner on the California State Athletic Commission, a member of the steering committee for the Sarah Jane Brain Project, a consultant for the National Hockey League Players' Association (NHLPA), a member of the concussion committee for Major League Soccer, a member of the Advisory Board for the American Association for Multi-Sensory Environments (AAMSE), and a subcommittee chair for the Centers for Disease Control and Prevention (CDC) Pediatric Mild Traumatic Brain Injury Guideline Workgroup; has received funding for travel for invited lectures on traumatic brain injury (TBI)/concussion; has received royalties from Blackwell Publishing for Neurological Differential Diagnosis; has received honoraria for invited lectures on TBI/concussion; has received research support from the National Institute of Neurological Disorders and Stroke/National Institutes of Health (NIH), University of California, Department of Defense (DOD), National Football League (NFL) Charities, Thrasher Research Foundation, Today's and Tomorrow's Children Fund, and the Child Neurology Foundation/ Winokur Family Foundation; and has given (and continues to give) expert testimony, has acted as a witness or consultant, or has prepared an affidavit for 2–4 legal cases per year.

J. Kutcher receives authorship royalties from UpToDate.com; receives research support from ElMindA, Ltd.; is the Director of the National Basketball Association Concussion Program; is a consultant for the NHLPA; has received funding for travel and honoraria for lectures on sports concussion for professional organizations; and has given expert testimony on TBI cases.

S. Ashwal serves on the medical advisory board for the Tuberous Sclerosis Association; serves as associate editor for Pediatric Neurology; has a patent pending for the use of Hierarchical Region Splitting (HRS) for imaging of stroke; receives royalties from publishing for Pediatric Neurology: Principles and Practice (coeditor for 6th edition, published in 2011); receives research support from National Institute of Neurological Disorders and Stroke grants for pediatric TBI and for use of advanced imaging for detecting neural stem cell migration after neonatal hypoxic-ischemic injury (HII) in a rat pup model; and has been called and continues to be called as treating physician once per year for children with nonaccidental trauma in legal proceedings.

J. Barth has received funding for travel and honoraria for lectures on sports concussion for professional organizations, has given expert testimony on TBI cases, and occasionally is asked to testify on neurocognitive matters related to clinical practice.

T. Getchius is a fulltime employee of the American Academy of Neurology.

G. Gioia has received funding for travel from Psychological Assessment Resources, Inc., and the Sarah Jane Brain Foundation; served in an editorial capacity for Psychological Assessment Resources, Inc.; receives royalties for publishing from Psychological Assessment Resources, Inc., and Immediate Post-Concussion Assessment and Cognitive Testing; has received honoraria from University of Miami Brain and Spinal Cord Conference and the State of Pennsylvania Department of Education; and has given expert testimony on one case of severe TBI.

G. Gronseth serves as a member of the editorial advisory board of Neurology Now and serves as the American Academy of Neurology Evidence-based Medicine Methodologist.

K. Guskiewicz serves on the editorial boards for the Journal of Athletic Training, Neurosurgery, and Exercise and Sport Science Reviews; serves as a member of concussion consensus writing committees for the National Athletic Trainers' Association (NATA), American Medical Society for Sports Medicine, and American College of Sports Medicine; serves on the National Collegiate Athletic Association's (NCAA) Health and Safety Advisory Committee for Concussion, the NFL's Head Neck and Spine Committee, and the NFL Players' Association's (NFLPA) Mackey-White Committee; has received funding for travel and honoraria for lectures on sports concussion for professional organizations; has given expert testimony on TBI/concussion cases; and has received research funding from the NIH, CDC, National Operating Committee for Standards in Athletic Equipment, NCAA, NFL Charities, NFLPA, USA Hockey, and NATA.

S. Mandel and G. Manley report no disclosures.

D. McKeag serves as Senior Associate Editor, Clinical Journal of Sports Medicine, and as Associate Editor, Current Sports Medicine Reports.

D. Thurman reports no disclosures.

R. Zafonte serves on editorial boards for Physical Medicine & Rehabilitation and Journal of Neurotrauma; receives royalties from Demos—Brain Injury Medicine Text; receives research support from the NIH, National Institute on Disability and Rehabilitation Research, DOD; and has given expert testimony for an evaluation for the Department of Justice.

Go to [Neurology.org](https://www.neurology.org) for full disclosures.

Guideline Endorser(s)

Child Neurology Society - Medical Specialty Society

National Association of Emergency Medical Services Physicians - Professional Association

National Association of School Psychologists - Professional Association

National Athletic Trainers' Association - Professional Association

National Football League Players Association - Professional Association

Neurocritical Care Society - Medical Specialty Society

Guideline Status

This is the current release of the guideline.

This guideline updates a previous version: American Academy of Neurology, Quality Standards Subcommittee. Practice parameter: the management of concussion in sports (summary statement). Neurology 1997 Mar;48(3):581-5. [66 references]

Guideline Availability

Electronic copies: A list of American Academy of Neurology (AAN) guidelines, along with a link to a Portable Document Format (PDF) file for this guideline, is available at the [AAN Web site](https://www.aan.com) .

Print copies: Available from the AAN Member Services Center, (800) 879-1960, or from AAN, 201 Chicago Avenue South, Minneapolis, MN 55415.

Availability of Companion Documents

The following are available:

- Evidence-based guideline update: evaluation and management of concussion in sports: report of the Guideline Development Subcommittee of the American Academy of Neurology (AAN). Full length guideline. St. Paul (MN): American Academy of Neurology; 2013. 119 p. Available in Portable Document Format (PDF) from the [American Academy of Neurology \(AAN\) Web site](https://www.aan.com) .

- Summary of evidence-based guideline update: evaluation and management of concussion in sports: report of the Guideline Development Subcommittee of the American Academy of Neurology. Data Supplement (e-appendices, e-references). 2013. Available from the [AAN Web site](#) .
- Update: evaluation and management of concussion in sports. Case presentation. St. Paul (MN): American Academy of Neurology; 2013. 4 p. Available in PDF from the [AAN Web site](#) .
- Update: evaluation and management of concussion in sports. AAN summary of evidence-based guidelines for clinicians. St. Paul (MN): American Academy of Neurology; 2013. 4 p. Available in PDF from the [AAN Web site](#) .
- Summary of evidence-based guideline update: evaluation and management of concussion in sports: report of the Guideline Development Subcommittee of the American Academy of Neurology. Slide presentation. St. Paul (MN): American Academy of Neurology. 2013. 29 p. Available in PDF from the [AAN Web site](#) .
- Recognizing sports concussion in athletes. AAN summary of evidence-based guidelines for sports coaches and athletic trainers. St. Paul (MN): American Academy of Neurology; 2013. 2 p. Available in PDF from the [AAN Web site](#) .
- AAN guideline development process [online]. St. Paul (MN): American Academy of Neurology (AAN). Available from the [AAN Web site](#) .

Patient Resources

The following is available:

- Concussion during sports activities. American Academy of Neurology (AAN) guideline summary of evidence-based guideline for patients and their families. St. Paul (MN): American Academy of Neurology; 2013. 2 p. Available in Portable Document Format (PDF) from the [AAN Web site](#) .

Please note: This patient information is intended to provide health professionals with information to share with their patients to help them better understand their health and their diagnosed disorders. By providing access to this patient information, it is not the intention of NGC to provide specific medical advice for particular patients. Rather we urge patients and their representatives to review this material and then to consult with a licensed health professional for evaluation of treatment options suitable for them as well as for diagnosis and answers to their personal medical questions. This patient information has been derived and prepared from a guideline for health care professionals included on NGC by the authors or publishers of that original guideline. The patient information is not reviewed by NGC to establish whether or not it accurately reflects the original guideline's content.

NGC Status

This NGC summary was completed by ECRI on December 1, 1998. The information was verified by the guideline developer as of June 11, 1999. This NGC summary was updated by ECRI Institute on April 24, 2013.

Copyright Statement

This NGC summary is based on the original guideline, which is copyrighted by the American Academy of Neurology (AAN).

Disclaimer

NGC Disclaimer

The National Guideline Clearinghouse[®] (NGC) does not develop, produce, approve, or endorse the guidelines represented on this site.

All guidelines summarized by NGC and hosted on our site are produced under the auspices of medical specialty societies, relevant professional associations, public or private organizations, other government agencies, health care organizations or plans, and similar entities.

Guidelines represented on the NGC Web site are submitted by guideline developers, and are screened solely to determine that they meet the NGC Inclusion Criteria which may be found at <http://www.guideline.gov/about/inclusion-criteria.aspx>.

NGC, AHRQ, and its contractor ECRI Institute make no warranties concerning the content or clinical efficacy or effectiveness of the clinical practice guidelines and related materials represented on this site. Moreover, the views and opinions of developers or authors of guidelines represented on this site do not necessarily state or reflect those of NGC, AHRQ, or its contractor ECRI Institute, and inclusion or hosting of guidelines in NGC may not be used for advertising or commercial endorsement purposes.

Readers with questions regarding guideline content are directed to contact the guideline developer.